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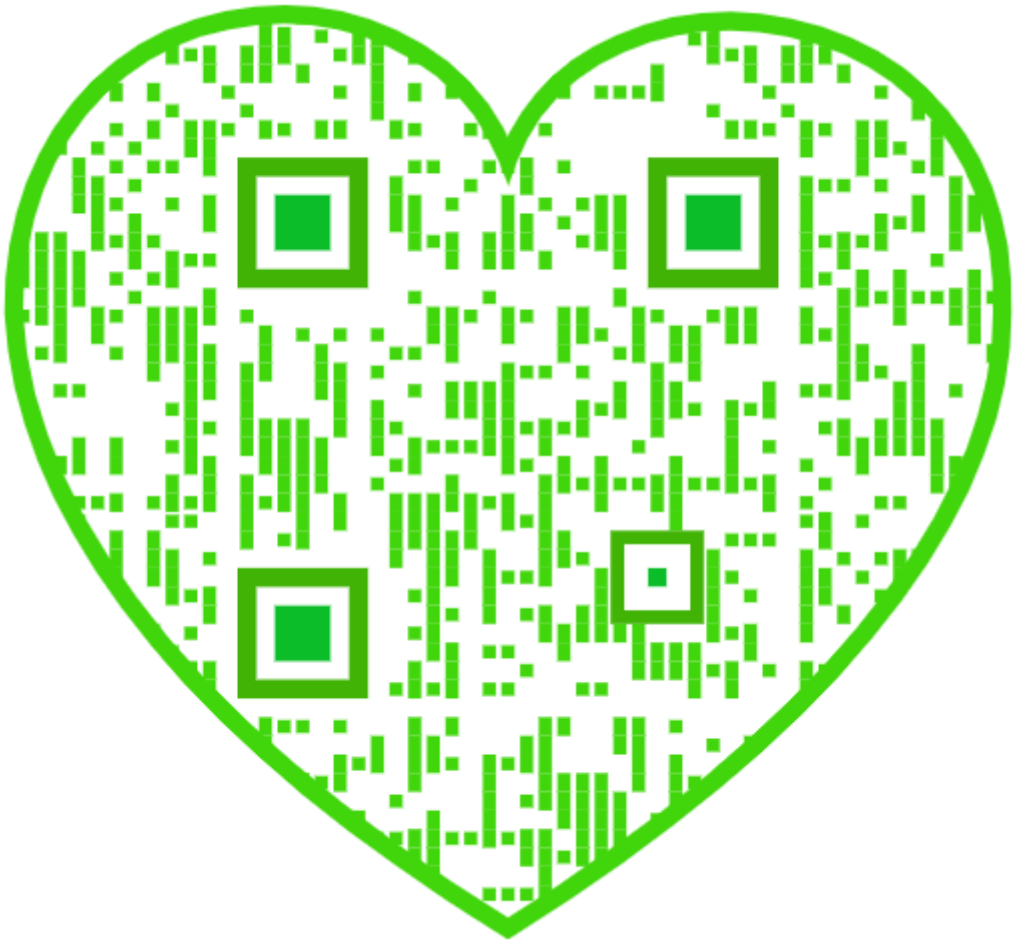
ECONOMIC TREE PLANTING.

BY
B. G. NORTHROP, LL.D.

NEW YORK
THE ORANGE JUDD COMPANY,
245 BROADWAY.
1878.



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This paper is reprinted from the Report of the Connecticut State Board of Agriculture. A few local allusions are retained to show the original aim of the writer and the application of kindred facts and plans to other fields.

An enlarged edition will soon be published under the title of "Tree-planting, Economic and Ornamental, and Village Improvement."

Public interest in rural adornment is rapidly increasing in Connecticut. This good work should go on till not a school-house, dwelling, or street is left without the simple and grand adornment of shade trees. A little foresight will show that no community can afford to be without a Village Improvement Association. In many towns such organizations have already done incalculable good in cultivating public spirit, quickening social and intellectual life, and enhancing the value of real estate. I shall be happy to co-operate with public-spirited citizens who are moving in this matter, and will lecture on this subject without charge either for services or expenses in any town in Connecticut.

U. S. Dept. Agri.
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ECONOMIC TREE-PLANTING.

BY HON. B. G. NORTHROP.

Being neither a scientist nor farmer, I have made no original investigations or practical experiments in forestry. Lest I may seem presumptuous in attempting to instruct others on a great subject in which I am myself a novice, reference is made to my opportunities for learning the matured views of those who, devoting their lives to this study, have made investigations and experiments on a broad scale. Three months of last summer were occupied in visiting "the Foresters," forest schools, and forest plantations of Europe. The letter of Governor Hubbard,* and one from Hon. Wm. M. Evarts, Secretary of State, bespeaking the coöperation of our ministers and consuls, whose aid might be needed, gave free access to all desired sources of information, especially the official "Departments of Forestry," forest schools and their professors, forest plantations, national, communal, or private, and their managers, and the parks and gardens on the Continent and in England. With note-book always in hand, I conferred with numerous authors in this department, as well as practical foresters. Gathering facts from so many experts, and condensing statements from so many sources, it is impracticable in this address to formally quote their language, which I have freely modified and abridged. In addition to the professors of the forest schools visited, and to many diplomatic agents, I

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*EXECUTIVE DEPARTMENT, HARTFORD, CONN., June 12, 1877.

I have signed these presents for the purpose of duly accrediting the Hon. B. G. Northrop, of the Board of Education of this State, who is commissioned by said Board to visit the Schools of Forestry and Forest Plantations, and the Industrial Schools of Europe, and report the results of his observations for the benefit of the schools and people of this State, and especially to encourage the reclamation of waste lands by the propagation of trees. I beg to commend Mr. Northrop to the courtesies and co-operation of all persons to whom these presents shall come, and particularly to those who are managers of the institutions above named, and are interested therein. In testimony whereof, I have hereunto set my hand. RICHARD D. HUBBARD.

am especially indebted to Hon. George P. Marsh, the American Minister to Rome, Captain Campbell Walker, Conservator of State Forests in New Zealand, J. C. Brown, LL. D., long Colonial Botanist at Cape of Good Hope, and J. McGregor, Forester of the Duke of Athole, for information given in personal interviews as well as for that derived from their published works.

The literature of forestry, already large, is now rapidly increasing by the coöperation of professors in forest schools, and government officials specially commissioned to investigate different branches of the subject, and many other writers. A German catalogue gives the titles of 1,815 volumes on forestry issued prior to 1842, and the titles of 650 works published in the six years prior to 1876. On an average, over one hundred new books on forestry appear annually in the German language. One of the Spanish Commissioners to the Centennial Exposition, Señor Morera, published a list of 1,126 volumes on forestry in the Spanish language alone.

Little attention has been given in this country to sylviculture. Nature has been wonderfully bountiful in the magnificent forests which once adorned this land, but our people have been recklessly prodigal in wasting this rich inheritance. As if they were the enemies of man, forests have been consumed without a thought of renewing them, and fire has been made to help the axe in destroying what it required ages to produce.

The progress of a nation may be measured to a large extent by its consumption of wood. Extensively as brick, stone, and iron may be substituted for wood in building, and coal used for fuel, the timber demand for purposes of utility and ornament will everywhere increase as civilization advances. The railways are enormous consumers of wood. Says Professor C. S. Sargent: "Supposing the life of a sleeper is seven years, the 85,000 miles of track in the United States consume annually 34,000,000 sleepers, or thirty years' growth on 68,000 acres of the best natural woodlands. At least 125,000 miles of fencing are required to enclose the railroads of the country, costing not less than $43,000,000, with large expenditures for annual

repairs. For the construction of 65,000 miles of telegraph lines in the United States, 2,000,000 trees for poles were required, while the annual repairs must call for 250,000 more." A late Agricultural Report of Illinois says: "The fences of the United States cost more than any other class of property except real estate and railroads; the total amount being estimated at eighteen hundred millions of dollars, with an annual expense of ninety-eight millions for repairs." Desirable as may be live hedges, stone walls or ditches, wooden fences are likely to be long used.

But aside from the need of fencing, and the demands for railway and telegraph companies, there are nearly seventy occupations enumerated in the last United States census which in whole or in part use wood as their raw material for manufacture, employing more than one million of artisans, such as carpenters, cabinet-makers, chair-makers, coach-makers, coopers, boat and ship builders, wheelwrights, manufacturers of brooms, brushes, matches, furniture, agricultural implements, machinery and the like. There are 63,928 establishments manufacturing articles made entirely of wood, employing 393,387 persons, and using materials worth $309,921,403 annually. There are, besides, 109,512 establishments in which wood is an important material, as for example, in pianos, carriages, bridges and ships, employing 700,915 persons, and using materials worth $488,530,844. With these facts before us, there need be no fear of an overproduction of wood. It is estimated that in our whole country over three million acres of wood-growing land are cleared annually, and this usually without any proper plans for reforesting them. Favorably situated as Connecticut is, in the midst of these industries and near the great market centers, and with new calls for exportation, there is sure to be a growing demand for all desirable lumber.

George Peabody, who did so much to encourage schools and learning, originated the motto, so happily illustrated by his own munificent gifts to promote education: "Education—the debt of the present to future generations." We owe it to our children to leave our lands the better for our tillage, and we

wrong both ourselves and them if our fields are impoverished by our improvidence. But much as foresight is admired when its predictions are realized and its achievements made, all history too plainly tells that the mass of men are not easily persuaded to provide for exigencies far in the future. It was more than two centuries after the death of Bernard Palissy, the famous "Potter of the Tuillerics," and after many sad lessons of devastating mountain torrents resulting from excessive forest denudation, before France learned to heed his earnest warning. Expressing his indignation at the folly of such general destruction of the woods he said: "I call it not error, but a curse and a calamity to all France. When I consider the value of the least clump of trees, I marvel at the great ignorance of men who do now-a-days study only to break down, fell and waste the fair forests which their forefathers did guard so choicely. I would think no evil of them for cutting down the woods, did they but replant some part of them again, but they care naught for the time to come, neither reck they of the great damage they do to their children." In 1680, the eminent French statesman, Colbert, said to Louis XIV.: "France will perish for want of wood."

It was not, however, till 1859 and 1860 that stringent laws were passed for the protection of existing woodlands and the formation of new forests. The former of these laws passed the Assembly by a vote of 246 against 4, and the latter with but a single negative voice. The unanimity with which these laws were enacted, though they seriously interfere with the rights of private domain, shows at last the strength of the popular conviction that the protection and extension of forests were matters of national interest and necessity, and would arrest the devastations of mountain torrents and river inundations. The law of 1860 appropriated 10,000,000 francs, at the rate of 1,000,000 a year, in aiding the replanting of woods. In 1865 a bill was passed for securing the soil in exposed localities by grading, and the formation of greensward.

This measure, proved to be beneficial in France, Mr. Marsh highly recommends for adoption in the United States. The leading features of this system are marking out and securing

from pasturage and browsing a zone along the banks of ravines, which is carefully turfed and planted with shrubs and trees; consolidating the scarps of the ravines by grading and wattling and establishing barriers of solid masonry, or more commonly of fascines, or other simple materials across the bed of the stream, and cutting narrow terraces along the scarps. Many hundred ravines, formerly the channels of formidable torrents, have been secured by barriers, and by grading and planting, and the success of the system has far surpassed all expectation. The plan of *circling*, long used in this country, is now adopted in France. This plan prevents the wash of the surface, and provides irrigation by running horizontal furrows along the hill-sides, and thus cheaply securing a succession of small terraces, checking the rapid flow of the surface water, obviating one cause of inundations, and greatly fertilizing the lands thus irrigated.

The evils of widespread forest denudation both as regards climatic changes, *uniform* flow of springs and streams, devastation by mountain torrents, and the exhaustion of once fertile lands, have been long and sadly felt in the Old World. Many rich and fertile countries have become arid wastes when denuded of trees. The Mediterranean coast of Africa is a case in point. Tunis and Algiers were once fertile regions, supporting a dense population. Their decadence is traceable largely to the destruction of their forests. Rentzsch ascribes the political decadence of Spain almost wholly to the destruction of the forests.

Mr. George P. Marsh says: "There are parts of Asia Minor, of Northern Africa, of Greece, and even of Alpine Europe, where causes set in action by man have brought the face of the earth to a desolation as complete as that of the moon, and yet they are known to have been once covered with luxuriant woods, verdant pastures, and fertile meadows; and a dense population formerly inhabited those *now* lonely districts. The fairest and fruitfulest provinces of the Roman empire once endowed with the greatest superiority of soil, climate, and position, are completely exhausted of their fertility, or so diminished in their productiveness as, with the

exception of a few favored cases that have escaped the general ruin, to be no longer capable of affording sustenance to civilized man. If to this realm of desolation we add the now wasted and solitary soils of Persia and the remoter East, that once fed their millions with milk and honey, we shall see that a territory larger than all Europe, the abundance of which sustained in by-gone centuries a population scarcely inferior to that of the whole Christian world at the present day, has been entirely withdrawn from human use, or at best is inhabited by tribes too few, poor, and uncultivated to contribute anything to the general, moral, or material interests of mankind. The destructive changes occasioned by the agency of man upon the flanks of the Alps, the Appenines, the Pyrenees, and other mountain ranges of Central and Southern Europe, and the progress of physical deterioration, have become so rapid that in some localities a single generation has witnessed the beginning and the end of the melancholy revolution. A destruction like that which has overwhelmed many once beautiful and fertile regions of Europe awaits an important part of the territory of the United States, unless prompt measures are taken to check the action of the destructive causes already in operation."

Indeed we have already a great Sahara in Connecticut produced by improvidence and neglect. The local traditions tell us that the "sand-blow," covering so large an area in the towns of North Haven and Wallingford, which, with its clouds of dust, is a literal eye-sore to all travelers on the New Haven & Hartford Railway, was once finely wooded. Here and there clumps of low cedars and pines, the lone relics of a former growth, still resist the drifting sands. So general is the conviction that this sand blow is utterly irreclaimable that it has long since been abandoned to hopeless sterility. I shall be happily disappointed if my plan for utilizing it is not regarded by many farmers as visionary and impracticable. The feasibility of reclaiming the barren sands of Connecticut, even the wastes of Wallingford and North Haven, is proved by many facts. While agent of the Massachusetts State Board of Education I visited every town of that State,

and found thousands of acres in Plymouth and Barnstable counties—once sandy plains—covered with fine forests. The common pitch pine has there been most generally used for the reclamation of sand barrens. Recently the Scotch pine has been widely planted. The seeds were sometimes sowed broadcast, and sometimes dropped in furrows. The cost was trifling, and the profit has been satisfactory.

Hummel attributes the desolation of the Karst, the high plateau lying north of Trieste—until recently one of the most parched and barren districts in Europe—to the felling of its woods, centuries ago, to build the navies of Venice. The Austrian government is now making energetic, and thus far successful efforts for the reclamation of this desolate waste, having planted over half a million of young trees, and sown great quantities of seed. In the vicinity of Antwerp less than fifty years ago was a vast desolate plain. Looking to-day in the same direction from the spire of the cathedral, one can see nothing but a forest, whose limits seem lost in the horizon. Forest plantations have transformed those barren lands into fertile fields. French writers point with pride to an experiment begun eighty years ago on the very crest of a peninsula in Dauphiny, where stands a long stretch of fine forest, and where it had been confidently affirmed trees could not be made to grow.

On the Adriatic, Baltic, Mediterranean, Biscayan, and other coasts, the disastrous encroachments of the sea have been checked by forest plantations. Extensive plains, once barren sands south of Berlin, about Odessa and north of the Black Sea and vast steppes in Russia, are now well wooded. R. Douglass & Sons of Waukegan, Illinois, who have been the pioneers in promoting economic tree planting in the West, began four years ago the experiment of reclaiming barren sand ridges near the shore of Lake Michigan, trying pitch pine, white pine, Austrian pine, and Scotch pine. Here, as on Cape Cod, the Scotch pine proved the best for reclaiming sandy barrens. With these facts from abroad and at home it cannot be denied that even the poorest soils in Connecticut may be reclaimed. The *Pinus maritima*, which proved best

for the sandy soils in France, is not adapted to the climate of New England. It has been amply tried, and though growing rapidly for a season or two, is likely to winter-kill. But our native pitch pine, and still better the Scotch pine, are specially adapted to sandy barrens.

Daniel Webster planted many pines at Marshfield, and induced farmers in Plymouth and Barnstable counties to try the same experiment. This has been done very extensively by Mr. J. S. Fay, in Falmouth, near Wood's Hole. In visiting Falmouth I was happily impressed with the beauty and remarkable growth of his tree plantations. There, is a tract of over one hundred and twenty-five acres now densely covered with fine trees. When purchased by him, Mr. Fay says, "It was a barren waste, the soil dry and worn out. On a hundred acres there was not a tree of any kind, unless an oak sprang out from the huckleberry bushes here and there, but hardly lifting its head above them. Indeed, when I bought my place in 1853, except a few stunted cedars on Parker's Point and in the swamps, there was not an evergreen tree within three miles of my house, and hardly any tree of any kind in sight of it. It was maintained that trees could not be made to grow there. The seeds sown were of the native pitch pine with some white pine, the Austrian, Scotch, and Corsican pine, the Norway spruce, and the European larch—in all about thirty-five thousand imported plants, and many thousand native pines. As to the kinds which have done the best, the Scotch pine *from the seed*, including *prompt* germination, has proved the best grower, and very hardy. The Norway spruce and English oak have done well. The larch did not start well from the *seed*, but from the nursery or as imported it has grown remarkably. The hardy Scotch pine does finely either from the seed or the nursery. All these imported trees have done better than the native pitch pine. The larches are about forty feet high, and fourteen inches in diameter one foot from the ground. Some Scotch pines from seed sown in 1861, well situated and in good soil, are thirty feet high, and ten inches through, a foot from the ground. As to profits, one thing is sure. The land, originally

poor, has been enriched by the deposit of thousands of loads of leaves upon it, and by the shade afforded, while the soil has been lightened and lifted by the permeation of the roots of the trees; and though no present profit has been yet realized, (which already might have been by sales of the wood,) it should be considered as an investment for future results. Considering the position of my place, on a coast exposed to violent sea winds permeated with salt spray, the vigorous growth and promising appearance of my forest plantations are very encouraging to those more favorably placed. Not only may the destruction of our forests be partially remedied at a cheap cost, but the *waste* and *sterility* of our land by long cultivating be replaced with fertility by the simple process of nature."

The Scotch fir or pine, which Mr. Fay so highly commends, is a native of the Highlands, a hardy tree, and the most rapid grower of all the evergreens suited to our climate—the European larch, a still more rapid grower, being deciduous. It will thrive in the most dissimilar soils and on poorest sands where most other evergreens will not flourish, and makes an excellent wind-break. Its timber is not duly appreciated in this country. In England it is as highly prized as the best Baltic pine, and regarded as superior to our white pine for general purposes. While skeptical on this point, we must at least admit that it is harder, more durable, and more resinous than the white pine. It is light, stiff, and strong, freer from knots than any other fir, easily worked, and well adapted to all kinds of house carpentry. It is extensively used for masts and in naval architecture. In England it yields large quantities of tar, turpentine, and resin. Next to the larch it is the tree most commonly planted in Great Britain. It should be extensively used in Connecticut in reclaiming lands too poor for the larch. It proved a great success in the sandy wastes of Kincorth and Culbin in Scotland, which are now thriving forests.

Among the foresters of largest experience in Europe, I found the planting out system growing in favor, in place of sowing the seed, whether in furrows or broadcast in the fields where

the trees are to remain. If sowing is adopted, the land, except on sand barrens, must be well prepared. The general practice abroad is to sow the seed in beds, as beet or onion beds are prepared with us. The Germans speak of the seedlings while in the nursery beds as "in the school," and this phrase happily suggests how they should be treated. The aim is here to start, harden, and root the young plants in a small area where they can be sheltered with brush or otherwise from the scorching sun, and watered if need be in case of drought.

If the seedlings are to be put out close by the garden, they may be planted direct from the mother bed at the end of one or two years. But when they are to be removed to any distance or planted as forests, they should be *transplanted* at the end of the first or second year and planted for forests one year later. The larch and Scotch pine are usually planted permanently, two years from sowing in beds and one year from the planting, that is three years from the seed. The direction is constantly repeated to let the trees grow up *very thickly for a few years*, as they will at first thin themselves on the theory of the survival of the fittest, and after the fifth year the value of the poles will pay for the further thinning required. When planted, the rows should not be more than three feet apart, and the plants stand two feet apart in the rows, giving some seven thousand to the acre, varying with the kind of trees. At the outset the trees are planted more thickly in Europe than in America.

Will it pay the average farmer of Connecticut to plant trees? Certainly not if early profit is essential. The answer depends on various circumstances, such as the size of one's farm, its soil and situation. But in an ordinary Connecticut farm of from sixty to one hundred acres and upwards, I answer yes. If you are looking ahead and seeking an investment for future profit, "trees will make dollars, for they will grow in waste places where nothing else can be profitably cultivated. A soil too thin and rough for cereals may be favorable for trees. Hillsides and plains exhausted and worn out by the plow have often been reclaimed by planting forests. Ravines too steep for cultivation are the favorite seats of timber, and

wherever a crevice is found in a rocky ledge, the root of a tree will burrow and spread, taking a hold so firm as to defy the storm, and acting mechanically to disintegrate the rock and change its constituent elements into useful products. By the road-side, the river-bank, along the brook, and on the overhanging cliff, a tree may be always earning wealth for its owners, both in our densest settlements and in the waste places of our most valuable lands." In no way can we ultimately enrich Connecticut more than by planting the choicest trees on our exhausted and unproductive lands. In such situations forests will yield a large percentage of profit. This is a duty we owe to ourselves and to our children.

In many positions forests are of great service as wind-breaks; even narrow strips of trees afford a needful shelter to fruit trees and to various crops, as well as a shield to cattle from piercing winds. Evergreens serve best for screens, as deciduous trees are leafless when their shelter is most needed, especially for stock and around farm buildings. The evergreens most suitable for this purpose are the Norway spruce, white pine, Scotch pine, and Austrian pine; and next to these are the American arbor vitæ, hemlock, and spruce. Sheltered orchards are most productive and less likely to lose their fruit prematurely by violent winds, and the farmer with proper wind-screens consumes less fuel in his house and less forage in his stables. Stated in the order of their obvious advantage to individual farmers, the benefits of tree-planting would be, first, direct profit in timber and fuel; second, the reclamation of waste land; third, shelter; fourth, climatic gain and hygienic influence; and fifth, ornamentation.

The climatic influence of forests has been of late the subject of extensive investigation in Europe, and much evidence gathered showing that forest denudation may result in detriment to the health and welfare of a community. The influence of forests on rainfall, climate, and water supply, has been freely discussed in the schools of forestry and in scientific circles. It is not proved that extensive denudation will cause a marked decrease in the *total* rainfall of any large country. While this is still an unsettled question, recent observations in France,

made with great care and complete sets of instruments at different stations, seem to establish the facts, first, that throughout the year six per cent. more rain falls in the forests than in the open fields; second, that of the total rainfall ten per cent. in the forest is caught by the leaves and reaches the earth very gradually, or not at all; and, third, that the evaporation in the open country is five times as great as in a forest.

But on the question of the influence of forests on climate and the *permanent* water supply, there is a growing unanimity among practical foresters and professors in the forest schools of Europe. Their theories and observations plainly show that the wholesale clearing of forests has an injurious effect on both, while the extensive planting of trees on arid regions has ameliorated the climate, prevented mountain torrents, and rendered the water supply more permanent. These investigations show that the general destruction of forests has rendered the climate dryer, more changeable and trying, and that forests on the one hand tend to lower the general temperature of a country and promote the fall of rain at more *regular* intervals, and on the other hand they ward off *sudden* meteorological changes which result in heavy falls of rain and disastrous floods.

It is well known that houses too closely surrounded by trees are damp. Beautiful and healthful as shade trees are, they may stand too near the house. Dense evergreens growing so close as to shut out all sunlight, are harmful. It is an old Italian proverb, that "where the sunlight cannot come the doctor must;" and sometimes the wisest direction of the physician to his rheumatic patient is, to cut down the tree which too densely overshadows the house and excludes all sunlight. The wetness of roads completely overshadowed by trees, shows how forests affect the humidity of the ground they cover. Mr. Marsh says: "One important conclusion at least is certain and undisputed, that within their own limits and near their own borders forests maintain a more uniform degree of humidity in the atmosphere than is observed in cleared grounds." Speaking of the indiscriminate clearing in

America, he says: "with the disappearance of the forest, all is changed. At one season, the earth parts with its warmth by radiation to an open sky, and at another receives heat from the unobstructed rays of the sun; hence the climate becomes excessive, and the soil is alternately parched by the fervor of summer and seared by the rigors of winter."

Wm. Cullen Bryant says: "Our summers are becoming dryer and our streams smaller. Take the Cuyahoga as an illustration. Fifty years ago large barges loaded with goods went up and down that river. Now, in an ordinary stage of the water, a canoe or skiff can hardly pass down the stream. And from the same cause—the destruction of our forests—other streams are drying up in summer." Almost every work on forestry abounds in evidence that extensive forest denudation has everywhere diminished the flow of springs. The case of the famous spring in the Island of Ascension is often cited, which dried up when the adjacent mountain was cleared, but reappeared in a few years after the wood was replanted. Several lakes in Switzerland showed a depression of their level after a general devastation of the forests. Siemoni says: "In a rocky nook in the Tuscan Apennines there flowed a perennial stream from three adjacent springs. On the disappearance of the woods around and above the springs the stream ceased, except in rainy weather, but when a new growth of wood again shaded the soil, the springs began to flow." Marchand says: "The river that from time immemorial furnished ample water-power for the factory at St. Ursanne dwindled so much when the surrounding woods were cut that the factory was at last obliged to stop altogether." President Chadbourne says that Salt Lake contains nearly twice as much water as it did when the Mormons came, and that the water supply is increasing throughout the territory, not by an increase of rain, but cultivation and extensive groves of trees have checked the influence of drying winds and lessened evaporation.*

* Near my residence (Woburn, Massachusetts,) there is a pond upon which mills have been standing since the early settlement of the town. These have been kept in constant operation until within thirty years, when the supply of water began to fail. The pond owes its existence to a stream which has its source in the hills stretching some miles to the south. Within the time mentioned,

I visited the planted forests of the Duke of Athole—whose estates, beginning near Dunkeld in Scotland, extend forty miles by ten—in company with Captain Campbell Walker, now the Conservator of State Forests in New Zealand, who was long employed in the same service in India. He said he had personally observed the drying up of springs and decrease of the *average* amount of water in some of the mountain forests in India, in which extensive clearing had taken place, and that such clearing had unquestionably lessened the *regular* supply for springs and permanent flow in the streams and rivers. While I was in England, the terrible famine in India resulting in the starvation of over seven hundred and fifty thousand people—more than the entire population of Connecticut and Rhode Island—was a prominent theme of public thought and talk and sympathy. Captain Walker, Dr. J. C. Brown, and other foresters expressed the view that forest denudation, diminishing the springs and lessening the former sources of artificial irrigation, was the leading cause of this terrible calamity. Under the early rule of the East India Company, there was a wide-spread devastation of the forests, and in later years the construction of extensive railway and telegraph lines have created a new demand for timber. Recently the English Government has adopted energetic measures for re-foresting the mountains, and placed the remaining forests under the supervision of competent foresters.

In a paper read to the Vienna Geographical Society in 1875, Herr Wex, Counsellor of State, and Director of the Government Works for the regulation of the flow of the Danube, affirms that in the last fifty years the decrease in the average level or comparison of the highest and lowest flow of the Elbe and Oder has been seventeen inches, the Rhine twenty-four, Vistula twenty-six, Danube at Orsova, fifty-five. These measurements, embracing the greatest flood

these hills, which were clothed with a dense forest, have been stripped of trees, and what was never heard of before, the stream itself has been entirely dry. Within the last ten years a new growth of wood has sprung up on the land formerly occupied by the old forest, and now the water runs through the year. DR. PIPER—*Trees of America.*

heights, the lowest flow, and the medium average flow, show that the *floods* are unquestionably higher than in former years, and the contrast between the highest and lowest flow is greater, and that these higher floods are no compensation for the diminution of the medium and low flood, and that many manufactories built during the last fifty years have experienced a marked diminution in the water supply of their streams, and steam-engines have been employed to meet the deficiency of water-power, once ample to do the same work.

The cause of this remarkable phenomena lies in the extensive clearing away of the forests, especially in the mountains, where deluges of rain occur more frequently; for, in lands devoid of trees, the rain water sinks less into the soil, but more speedily reaches the brooks, streams, and rivers, and fills and overflows these water-courses, and results in disastrous floods. The correctness of this conclusion is sadly attested by the now frequently recurring inundations in Italy, in the south of France, Hungary, Bohemia, and in many other lands. It may be worthy of inquiry whether the general clearing of the mountain forests around Salisbury, Connecticut, to meet the growing demand for charcoal for the furnaces, had any connection with the desolating flood which occurred in that town four years ago. A resident of Salisbury, whose farm lies near the base of the mountain skirting that town, says that a stream on his land, formerly never failing, has dried up every summer for the last twenty years.

By several learned societies—like the Royal Academy of Science of Vienna, and the Imperial Academy of Science of St. Petersburg—commissioners were appointed to report upon the paper of Wex, and their reports substantially confirm his views, and say: "Forests exercise a beneficial influence which can hardly be estimated too highly in an increased humidity of the air, a reduction of the extremes of temperature, a diminution of evaporation, and a more *regular* distribution of the rainfall, while the injurious effects of their destruction is seen in an alternation of periods of drought at one time with wasting floods at another." The forests serve as storehouses of moisture, both from their leafy canopy which shuts out the

sun, and the myriads, or rather millions, of leaves covering the soil and acting like a sponge, soaking up and retaining the rain and regulating its distribution, while the roots act as vertical drains, favoring infiltration and promoting the descent of the water into the lower strata of the earth, there to nourish the springs.

Among the works of Dr. J. C. Brown on Forestry—the most voluminous writer on this subject in the English language—is one on "*Reboisement* in France," or the replanting of the Alps, the Cevennes, and the Pyrenees, to arrest and prevent the destructive consequences of torrents. He clearly shows from official documents what fearful inundations resulted from the over-clearing of forests, and describes the remedial measures now in progress, which are to extend through many years and to cost over twelve millions of francs. But the loss of property by the terrible inundations in the south of France in 1875 was estimated by the *government* at seventy-five millions of francs, besides the loss of over three thousand lives. This was the work of a single year. The sad lessons of other torrents and other years have now at length led to systematic efforts to re-clothe their mountains.

The benefits that may accrue to our country from the discussion of tree-planting, were strikingly exhibited two hundred and fourteen years ago, when Sir John Evelyn published his celebrated work, entitled, "Sylva; or, a Discourse on Forest Trees and the Propagation of Timber." It was at once received with great public favor, and honored with royal commendation. He had remarkable success in awakening general interest in sylviculture. It was written while he was employed in an entirely different branch of public service, but, as he says, "from an earnest desire to support the credit of the Royal Society, and to convince the world that philosophy was not barely an amusement, fit only to employ the time of melancholy and speculative people, but a high and useful science, worthy the attention of men of the greatest parts, and capable of contributing in a supreme degree to the welfare of the nation." He was one of the founders of the Royal Society, and wrote this book at its special request, and that society

has originated few books in the last two hundred years more useful than this which still survives in its grand results, although his other works on painting, sculpture, architecture, and medals have long since been forgotten. In many ways England has recognized her great obligations to the man who worked so lovingly and effectively for the good of his countrymen.

Disraeli, in his "Curiosities of Literature," fittingly says: "Had Evelyn only composed the great work of his Sylva, his name would have excited the gratitude of posterity. The voice of the patriot exults in the dedication to Charles II, prefixed to one of the later editions, in which he says: 'I need not acquaint your Majesty how many millions of *timber* trees, besides infinite others, have been planted throughout your vast dominions at the instigation of this work, because your Majesty has been pleased to own it publicly for my encouragement.' Surely, while Britain retains her situation among the nations of Europe, the Sylva of Evelyn will endure with her triumphant oaks. It was a retired philosopher who aroused the genius of the nation, and who, casting a prophetic eye towards the age in which we live, contributed to secure our sovereignty of the seas. The present navy of Great Britain has been constructed with the oaks which the genius of John Evelyn planted."

What trees shall we plant in Connecticut? One of the most valuable of our native trees is the white ash, and, all things considered, it is one of the most profitable for planting. Combining lightness, strength, toughness, elasticity, and beauty of grain in a rare degree, it is in great and growing demand for farming tools, furniture, interior finishing of houses and railroad cars, the construction of carriages, for oars and pulley-blocks, and many other purposes. The excellence of our ash is one secret of the preference given abroad to American agricultural implements. It is hardy, will bear the bleakest exposure, is a rapid grower, and attains large size, but will not thrive on poor lands. It is every way superior to the European ash, much as that has been cultivated and lauded abroad. It is now found widely in the nurseries

and young plantations attached to the forest schools of Europe. Director-General Adolfo Di Béranger, President of the Royal Instituto Forestale at Vallombrosa, pointed me to his plantations of *Fraxinus Americana* with a tone which implied that is the tree of which Americans may well be proud.

The ash is a fine ornamental tree for private grounds, public parks, or for the way-side. When planted closely for timber they grow straight and free from low laterals, and early reach a size that makes the thinnings valuable for poles and fencing. Mr. Budd, a tree grower of Iowa, says: "A grove of ten acres thinned to six feet apart, containing twelve thousand trees, at twelve years were eight inches in diameter and thirty-five feet high, the previous thinning paying all expenses of planting and cultivation. Ten feet of the bodies of these trees were worth, for making bent stuff, etc., forty cents each, and the remaining top ten cents, making a total of $6,000 as the profit of ten acres in twelve years, or a yearly profit of $50 per acre." Mr. Edward Norton of Farmington has about sixteen thousand white ash plants, raised from last year's seed, now in rows to be planted next spring. They are very thrifty, and average about one foot in height. Very few of them died during the summer. He has gathered seed enough for about one hundred thousand plants, which he intends to start next spring.

The seeds of the ash are abundant, ripening by the first of October. They may be easily gathered after the first frost. If sown in the fall they should be covered with three inches of straw. If to be sown in the spring the seed may be mixed with damp sand. With all seedlings care should be taken to keep down the weeds. In some of the nurseries connected with the forest schools, I noticed the seed-beds were protected by green bushes during the hottest and dryest part of the summer. For field planting, the land should be plowed and made mellow in the autumn, that the trees may be planted early in the spring. A little over five thousand plants will be required to the acre, where they are set in rows four feet apart, and two feet apart in the

rows. The weeds can be kept down for three years with a cultivator, when the ground will be sufficiently shaded to require no further cultivation.

Connecticut is rich in its variety of native trees, having nearly sixty species, of which about forty are sizable for timber. Among the native trees worthy of cultivation may be named the white ash, white oak, sugar maple, chestnut, hickory, butternut, white pine, willow, and the elm. The latter, when growing under favoring conditions, has been pronounced "the most magnificent vegetable of the temperate zone." Much as the willow has been used as an ornamental tree, its economic value has not been appreciated in this country. The white willow is especially commended by experienced arborists. While most at home in low grounds and beside streams, it is hardy and will grow, though not as thriftily, on dry uplands and in poor soils. Professor William H. Brewer says: "In England, where it is often sixty or seventy feet high in twenty years, there is no wood in greater demand than good willow. It is light, very tough, soft, takes a good finish, will bear more pounding and knocks than any other wood grown there, and hence its use for cricket bats, for floats to paddle-wheels of steamers, and brake-blocks on cars. It is used extensively for turning, planking coasting vessels, furniture, ox-yokes, wooden legs, shoe-lasts, etc. Its charcoal is used for making gunpowder, its bark for tanning, its sprouts for withes and baskets. In some sections of Europe it has been planted from remote times as one of their most valued trees." Starting from cuttings and growing rapidly it can be very easily propagated. Fuller says: "It groweth incredibly fast—it being a by-word that the profit by willows will buy the owner a horse before that by other trees will pay for the saddle." Mr. Sargent says: "As willow timber could be produced far more cheaply than that of any of our native trees, it should soon come into general use here for the purposes requiring lightness, pliancy, elasticity, and toughness—qualities which it possesses in an eminent degree, and for which more valuable woods are now employed. Less than one-third of the willow used in the United States for basket making is produced here,

the remainder being imported from Great Britain, France, Holland, and Belgium, at an annual cost of five millions of dollars. The osier proper, the product of *Salix viminalis* and its allies, can be grown without trouble in any wet, undrained soil, capable of producing little else of value; but the better sorts of basket willow are only successfully produced with careful cultivation on rich, well-drained soil. Under such conditions it is a profitable crop, capable of netting at least $150 a year to the acre, and well worth the attention of our farmers." The experiment of raising willows is worth trying, though I do not anticipate so large profits as Professor Sargent promises.

For the reclamation of our pastures and waste lands abandoned to hard-hack, sumac, and other worthless brush, the European larch deserves to become a favorite. A native of the Alps, Apennines, of the Tyrol and Carpathian Mountains, it is a very hardy tree, and at home in a variety of well-drained soils, especially on rough, rocky, or gravelly ground, and the most rugged ravines. There are in our State large tracts of bleak hill-sides and mountain declivities or summits, now practically worthless, where the larch, thickly planted, would soon choke out brush, weeds, and grasses. As an ornamental tree it grows finely even in deep and rich loam, but its extraordinary qualities for timber may be impaired when grown on the rich prairies of the West or the best lands of the East. When raised under right conditions it combines the two qualities of rapidity of growth and durability of wood more than any other tree. This wood was in high favor with the Romans for the building of ships and bridges. Julius Cæsar spoke strongly of its strength and durability.

Last summer I heard a lumber-man in Venice say that its durability was amply attested there, as most of the houses of the city are built upon larch piles, many of which, though in use for centuries, show no signs of decay. In a large Doge's palace, now used as a hotel, he showed me some very ancient larch window-casings which are still sound. For gondola posts in the canals adjoining the houses the larch is preferred. In wharves and many other positions in England where there

is an alternation of wet and dry with the tide, the larch has stood this most trying test far better than oak. In England it is regarded as the best timber for railway ties. Monville says: "In Switzerland, the larch, as the most durable of woods, is preferred for shingles, fences, and vine-props. These vine-props remain fixed for years, and see crop after crop of vines bear their fruit and perish without showing any symptoms of decay. Props of silver fir would not last more than ten years." Evelyn says: "It makes everlasting spouts and pent-houses, which need neither pitch nor painting to preserve them." Michie affirms that "For out-door work it is the most durable of all descriptions of wood. I have known larch posts that have stood for nearly fifty years." Professor Sargent expresses the opinion that "For posts it will equal in durability our red cedar, while in the power to hold nails it is greatly its superior." The chestnut railway sleeper loses its power to hold iron in about seven years, though the tie itself may not so soon seriously rot. The larch, while it holds iron as firmly as oak, unlike the latter, does not corrode iron.

The Boston & Albany Railway have larch ties in use for sixteen years which are still sound. The president of the Illinois Central Railway, having examined the vast planted forests of larch in Europe and learned its remarkable fitness for railway ties, offers to transport the young plants free of charge to any point on their lines or leased lines, provided they are to be planted in the vicinity of the same. It is, however, an experiment which time alone can determine, whether the larch will retain its durability when planted in the level, deep, vegetable mould of the prairies, with their retentive sub-soil. That it will grow there rapidly and luxuriantly is amply proved, but its history for many centuries shows that elevated lands suit it better than low grounds, and side-hills and mountain slopes better than flats. In the rich river flats of Kew Gardens and in the vicinity of London the larch does not thrive. The specimens found in that remarkable collection of all known trees are puny. The Kew arborist informed me that in the two hundred and seventy acres appropriated to the arboretum, no spot had been found suited to the larch. Mr. James Brown,

an experienced forester of Scotland, attributes the disease, which has of late prevailed in many larch plantations in that country, to planting it, both in the nursery and the field, in uncongenial soil.

No other tree has been planted so extensively in Scotland. It attains maturity long before the oak, and serves well for nearly all purposes for which oak is used. Larch trees thirty years old are sometimes sold for fifteen dollars each, while oaks of the same age are not worth three dollars each. According to Newlands the strength of larch timber is to that of British oak as 103 to 100; its stiffness as 79 to 100; while its toughness is as 134 to 100. As the larch grows erect, with short and slender laterals, it may be planted much thicker than the oak. According to Loudon ten acres of larch will furnish as much ship timber as seventy-five acres of oak. Its large timber yield per acre is one source of its popularity in Britain. It was first planted on the estate of the Duke of Athole, in 1741. Some stately specimens over one hundred and thirty years old may be seen near the cathedral at Dunkeld. Mr. McGregor, the duke's forester, informed me that on this one estate have been planted over twenty-seven millions of larch trees, covering over sixteen thousand acres, some of which was formerly worth only from one to two shillings per acre.

Dr. James Brown says he has seen matured crops of larch of sixty-five years' standing sold for from $750 to $2,000 per acre, when the land was originally worth only from $2 to $4 per acre. Mr. Sargent, director of the Botanic Garden and Arboretum of Harvard College, gives a detailed estimate of the profits of a plantation of European larch of ten acres to last fifty years, calculating the cost for land, fencing, plants, labor, taxes, and interest, and makes the net gain to be $52,282.75, or about thirteen per cent. per annum for the entire fifty years, after retaining the original capital, and he adds: "There are in Massachusetts fully 200,000 acres of unimproved land which could, with advantage, be at once covered with larch plantations, and if so planted their net yield, according to my estimate, in fifty years would be

$1,045,660,000. Supposing that these 200,000 acres will, in the natural course of events, produce, during the same time, one hundred cords of fire-wood to the acre, worth six dollars a cord, amounting to $120,000,000, and subtracting this sum from the net yield of the larch, we have left, as created wealth, the respectable sum of $925,000,000."

Mr. Sargent, however, admits that this is farming *on paper*, and that considerable allowances should be made for such contingencies as fire, tree diseases, insect attacks, and other dangers now unforeseen. Robert Douglas of Illinois, who has had far more experience in larch planting than any other American, writes me that the larch in this country is remarkably free from all disease and insect depredations.

My special aim has been to encourage the recuperation of sterile lands by tree planting. The experiments of thus reclaiming barren tracts, which have been tried on a large scale in many European countries, prove the superiority of the larch for this purpose over all other evergreens, because it is deciduous. Grigor says: "No tree is so valuable as the larch in its fertilizing effects, arising from the richness of its foliage, which it sheds *annually*. The yearly deposit is very great; the leaves remain and are consumed on the spot where they drop." Trees also enrich the soil by a curious chemistry which disintegrates even the rocks, and transmutes their particles into forms of life and beauty. The radicles and rootlets, in their underground laboratory, secrete acids which dissolve the very sands and stones.

The frequency of forest fires is urged as an objection to tree-planting. Here is a real discouragement; but forests are no more likely to be burned than are our barns and dwellings. More property is consumed every year by the burning of stores and houses in this country than by forest fires. This danger, therefore, should no more prevent tree-planting than house-building. But such views need to be spread among all classes of the American people as will produce the general conviction that the interests of all classes are concerned in the protection and conservation of forests. The schools of forestry have made this sentiment wellnigh universal in

Germany, and all classes there appreciate their value and the need of protecting them. Browsing and pasturage in certain limits are prohibited, and yet the forests are not fenced. Simple marks designate where cattle may pasture and where they may not, and an intelligent public sentiment is a better guardian of the national or communal forests than official watchers or national police.

In some portions of Germany the law formerly required every landholder to plant trees along his road frontage. Happy would it be for us if the sovereigns of our soil would make each such a law for himself. Happy, also, if the law of usage, fashion, or interest here, as did the civil law there, required that every young man before he married should plant a tree. In some of our Western States tree-planting by the road-side is encouraged by a bounty from the State treasury, and in the fields by both a bounty and exemption from taxation for a term of years. The law in Minnesota provides that "every person planting, protecting and cultivating forest trees for three years, one-half mile or more along any public highway, shall be entitled to receive for ten years thereafter an annual bounty of two dollars for each half-mile so planted and cultivated, to be paid out of the State treasury; but such bounty shall not be paid any longer than such line of trees is maintained." If I may be pardoned for repeating a personal allusion, the maples which I planted, when a mere boy, before the old homestead in Litchfield county, are now beautiful and stately trees. As I have often said, they have paid me a thousand-fold for the work they cost, and added new charms to that beautiful spot, to which I count it a privilege to make an annual visit. Among the memories of my boyhood, no day has recurred with such frequency and satisfaction as that then devoted to tree-planting. My interest in the subject is due to this incident (or perhaps accident) of my boyhood. I should be thankful if I could help put a similar incident, and an equally grateful experience, into the childhood of our boys of to-day. In this good work may I earnestly bespeak the coöperation of the farmers of Connecticut.

In tree-planting, the economic and ornamental touch at so

many points that the cases are rare where they really diverge. Nothing, for example, can add so much to the beauty and attractiveness of our country roads as long avenues of fine trees. I saw this beautifully illustrated in France, last summer, where, for over a hundred miles on a stretch, the road was lined with trees. In many ways the first Napoleon's interest in arboriculture proved a benefaction to France. No time should be lost in securing the same grand attraction to the highways of Connecticut. Growing on land otherwise running to waste, such trees would yield most satisfactory returns. The shade and beauty would be grateful to every traveler, but doubly so to the owner and the planter, as the happy experience of many Connecticut farmers can testify. A grand work in this direction is already well started. No class can contribute so much to the adornment of our public roads as the farmers. They have already in abundance the very best trees for the roadside, such as the elm, maple, ash, American linden (or bass), oak, and in some localities the walnut. The hard maple will thrive in dry and gravelly soils, while the elm and red maple are specially desirable for moist, low ground. As the maples should be planted twenty-five feet apart, and the elms from forty to fifty, poplars or willows or trees growing rapidly from scions, may be placed between, to be cut down when their statelier neighbors require the room for their full development.

Tree-planting is fitted to give a needful lesson of forethought to the juvenile mind. Living only in the present and for the present, too often youth will sow only where they can quickly reap. A meager crop soon in hand, outweighs a golden harvest long in maturing. Youth should learn to forecast the future as the condition of wisdom. Arboriculture is a discipline in foresight—it is always planting for the future, and sometimes for the distant future. Says Washington Irving, "There is something nobly simple and pure in such a taste for trees. It argues a sweet and generous nature to have this strong friendship for the hardy and glorious sons of the forest. There is a serene majesty in woodland scenery that enters into the soul, dilates and elevates it, and fills it

with noble inclinations. There is a grandeur of thought connected with this heroic line of husbandry. It is worthy of liberal and free-born and aspiring men. He who plants an oak, looks forward to future ages and plants for posterity. He cannot expect to enjoy its shelter, but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile, and shall keep on flourishing and increasing and benefiting mankind long after he has ceased to tread his paternal fields." It was the trees of his own planting at Sunnyside-on-the-Hudson, more than the beauty of the surrounding landscape, that led Irving to say, "After all my wanderings, I return to this spot with a heartfelt preference for it over all others in the world." It was the simple beauty he had created at Marshfield,—the grassy lawns, the shaded approaches, the hundreds of trees of his planting,—that bound Daniel Webster so strongly to that sequestered spot. The charm of Abbotsford, the grand Mecca of Scotland, comes mainly from its beautiful ivy and shrubbery and the thousands of trees planted by the hand of its illustrious proprietor. Says Sir Walter Scott, "My heart clings to this place I have created. There is scarce a tree in it that does not owe its being to me. Once well planted, a tree will grow when you are sleeping, and it is almost the only thing that needs no tending."

Any wealthy citizens of Connecticut, who desire to become public benefactors, can hardly find a more inviting field for their liberality than by offering prizes for sylviculture. A few thousand dollars placed in the hands of the Connecticut Board of Agriculture would widely stimulate tree-planting, and greatly enrich the State. The Massachusetts Society for Promoting Agriculture, offer three thousand dollars in the following prizes:

First. For the best plantation of not less than five acres, $1,000; for the next best, $600; and for the next best, $400. For these prizes the European larch must be planted, except in Barnstable, Dukes, and Nantucket counties, where the Scotch pine or Corsican pine must be used, as best adapted to sandy plains. Only plantations made on poor, worn-out

land, or that which is unfit for agricultural purposes, and containing at least 2,700 trees to the acre, can compete for these prizes.

Second. For the best plantation of American white ash, of not less than five acres in extent, $600; for the next best, $400. Plantations originally of less than 5,000 trees to the acre, cannot compete for these prizes.

The following directions for tree-planting are condensed from the recommendations given by the trustees of the prize fund. For planting larch and pine, shallow furrows four feet apart should be run one way across the field. Then by planting in the furrows four feet apart each way, 2,720 plants will be required to the acre. On hilly, rocky land which cannot be plowed, it will be only necessary to open with a spade, holes large enough to admit the roots of the plants. *The larch must be planted as early in the season as the ground can be worked.* No other tree begins to grow so early, and too late planting is a common cause of failure. The Scotch and Corsican pines can be planted up to the first of May. The roots should be exposed to the wind and sun as little as possible. Carelessness in this particular is often fatal to the young plants. The trees should be carried to the field in bundles, covered with wet mats, and not be removed till they are required for planting. The roots should be carefully spread out in the holes or furrows prepared for them, and the soil worked among them with the hand, and finally pressed down with the foot. A cloudy or rainy day is especially favorable for this work. All young plantations *must be protected* from browsing animals, the greatest enemies, next to man, to young trees and the spread of forest growth.

If the New York, New Haven & Hartford Railroad reclaim the strip of land bordering their line through the "sand-blow," the example would be a benefaction to the State as a demonstration of what may be accomplished under the most unfavorable circumstances. If that desert can be reclaimed, surely all other barrens in Connecticut may be fertilized by forests. This enterprise will require time, faith, patience, and money. For the first four years the young trees may seem

to barely struggle between life and death, after which they are likely to grow rapidly. As this scheme will be regarded as chimerical by those who have not investigated the subject, I give below extracts from letters which I have received from practical tree-planters on Cape Cod and elsewhere, embodying interesting facts and practical suggestions.

John Doane, Orleans. (Mr. Doane, now eighty-six years of age, is the oldest living sylviculturist in Barnstable County.) I have planted one hundred acres in Orleans and seventy in Brewster. The whole plantation in Orleans is about five hundred acres; in Eastham seven hundred acres; in Wellfleet four hundred; in Truro six hundred; in Chatham, Harwich, Dennis, and Yarmouth, about four hundred each; and in Barnstable six hundred acres. In regard to the other towns on Cape Cod I have no definite information, though trees have been planted in many towns on the Cape. I have made a machine for planting the seed, that I have lent to the tree-planters in five of the neighboring towns. The land I have planted with pines was not worth over fifty cents per acre before planting, and I have sold some since covered with young pines, for fourteen dollars per acre. I consider it a good investment.

John Kenrick, South Orleans.--My experiments in tree-planting have been made on over a hundred acres now covered with trees from one to thirty-five years old, chiefly pitch pine. I am now trying Scotch and Corsican pine, and European larch. My first aim has been to cover my worn-out lands with beauty and verdure, and it has proved a successful and economic experiment. The seed of the pitch pine is worth from one to two dollars a pound, the higher price being in the end the cheapest. Fresh seeds, *carefully gathered*, are as sure to vegetate as corn, but obtained from seedsmen, they are very unreliable in germinating. European nurserymen take far greater pains in gathering forest tree seeds, and understand the art of curing them better than Americans. I have tried every method of tree planting, transplanting trees from the smallest to those that are two feet high. This is a costly plan, but may be adopted when one wishes to save time, and desires a few trees as a wind break or otherwise. In transplanting trees *immediately* from my own nursery to the field, my favorite time is just as the buds begin to start in the spring. I have planted seeds both with a planter and by hand. On our light sands a man and boy will plant three acres in a day. Dropping six seeds in a hill, it will take about half a pound of seed to the acre. This is my favorite method, and is more satisfactory in results, though more costly than that of using the plow and planter. When the evergreens are about two feet high I would thin them, leaving one thrifty plant in each hill. I do not trim till they get large, and then cut off only the dead branches.

Tully Crosby, Brewster. In our small town about fifteen hundred acres of old waste land have been planted with pitch-pine. The Norway pine has not proved a success with us. Many old fields bought for fifty cents per acre, and planted with pine twenty-five years ago, are now worth from ten to twenty dollars an acre. The pines grow well for twenty-five or thirty years, and when cut off a second crop springs up immediately, and this crop does better than the first. The pitch-pine takes root and grows *on our barren beach sand where no soil is perceptible.* Our people are now planting trees every year. I have recently planted twelve acres. Two years ago I cut off a lot planted thirty years since, and the land is now full of young pine trees growing from the seed scattered by the first growth. A man with a two horse team can plant ten acres in a day, and three pounds of seed will do the whole.

E. Higgins, Eastham. Thirty years ago twenty acres of condemned tillage land, worth one dollar per acre, was planted with pitch pine. The present value of this land is fifteen dollars per acre. Prior to 1870, two hundred and twenty-five acres more of the same sort of land was thus planted, the present value of

which is eight dollars per acre. About one hundred and fifty acres of *sandy* land, utterly barren and not worth fifty cents to the acre, have been planted, the present value of which is seven dollars per acre.

John G. Thompson, North Truro. About six hundred and fifty acres have been planted in this town. The price of pitch pine seed for the last few years has been one dollar and fifty cents per pound. Thirty years ago land in this town could be bought for twenty five cents per acre for tree-planting; now the same kind of barren land sells for two dollars per acre for tree-planting. I find the expense of planting the pines to be two dollars and twenty-five cents per acre.

S. B. Phinney, Barnstable. Large tracts of worn-out lands in this county, that were worth comparatively nothing, have been planted from the seed of the pitch-pine. These experiments have proved successful. I know of no way in which the light sandy lands in this section can be made so valuable as by planting them with the pitch-pine. Our experience proves that the cultivation of forest trees is feasible and profitable in New England seaport towns. In 1845 I planted in this town a ten-acre lot with pitch-pine seed, much as corn is planted, dropping three seeds in a hill and covering them with half an inch of soil. To-day many of these trees will girth more than a man's body. Hundreds of acres in this section are being planted annually.

J. E. Crane, Bridgewater. The most profitable tree we have planted in this region is the white pine, with which about two hundred acres have been planted on old worn-out pasture and light sandy soil. The cost of planting, that is, *setting out young trees* twelve to eighteen inches high, is about eight dollars per acre. Properly set out, scarcely one in fifty will fail. There is in this vicinity an acre that was set out thirty five years ago, that has just yielded in cash for the *wood and lumber*, $350. On another acre, planted twenty-eight years ago, there is estimated to be from eighty to one hundred cords. These are unusual specimens, but fifty cords per acre in twenty-five years, is a low estimate on land natural to pine, and pine is the most valuable growth of wood in the Old Colony.

F. Collamore, Pembroke. Forty years since, Hon. Morrill Allen, "the model farmer" of Plymouth county, planted white pines which grew rapidly, and have proved very valuable for the manufacture of wooden packing-boxes. His example has been followed to a limited extent. Every one believes in the profit of it, but we are in a well-wooded region, and when a lot is cut off it soon starts up again.

Robert Douglas and Sons, Waukegan, Illinois. We have propagated the European larch for nearly twenty years. For a number of years, and until the financial collapse, we sowed over *one thousand pounds of larch seeds* annually, averaging five to seven thousand plants to the pound of seed. The larch grows finely and rapidly in the New England States, in northern Illinois, Iowa, Minnesota, and Wisconsin. It grows nearly as fast, and makes more durable timber on poor lands than on very rich lands. There is no land so poor, except blowing sands, but that it will make a rapid growth after it is once fairly established. It is a tree adapted to a northern climate, and does not thrive in Kansas, southern Illinois, and south of Pennsylvania. We are growing the native cherry (*Cerasus serotina*) in large quantities, as it is healthy, transplants well, grows rapidly on land far from rich, and the timber is very valuable. We will send our catalogues, giving fuller information, to any party in Connecticut on application. The European larch should be planted as early as possible in the spring. It should never be planted on low wet ground. Set out early, no tree will bear transplanting better. Scotch pine and larch do well mixed. We recommend planting a few rows of the admixture on the margin of the plantation. When planted four feet by four, as we advise, they can be worked both ways with the cultivator for two or three years, when the branches will shade the ground so deasely as to destroy the undergrowth. When the trees are received from the nursery, the boxes should be immediately unpacked and the *roots* dipped into a puddle made of rich, mellow soil about the thickness of paint, and kept in a shaded place till ready to plant, but the tops should be kept dry. Set the trees a little deeper than they stood in the nursery. After treading the earth firmly about the roots, draw a little loose earth up to the trees to prevent the surface from baking.

Francis Skinner, Brookline, a Trustee of Massachusetts Society for Promoting Agriculture. I will receive and transmit orders for any number of trees for plantations in Connecticut to Douglas & Sons, Waukegan, Illinois. By arrangement with them, such orders transmitted through you are subject to fifteen per cent. discount from the catalogue prices, and such orders can be transmitted up to April 1st, except for European larch, for which the closing time will be March 1st. We are filling our Massachusetts orders from Douglas & Sons in preference to importing from England, as they are cheaper when ordered in large quantities, and the chances of their success far greater. American white ash, one or two years old and about one foot high, are from $3 to $5.50 per thousand; European larch from $4 to $8 per thousand. As this duty is undertaken solely from a desire to facilitate tree-planting, and not for the purpose of any personal gain, I cannot be held responsible in any way for the results.

A. W. Holley, Salisbury, Conn.—The consumption of wood in this and surrounding towns has been very great in supplying charcoal to our numerous iron works. Some of the mountains have been stripped of their trees three times within the last century. The second growth was rapid. Each subsequent one has been less vigorous and less rapid. Other varieties, aided by artificial means, such as seeding, placing cuttings, or transplanting the young trees, might soon render our mountains valuable again for the production of forests. Our landowners have not paid sufficient attention to the propagation of trees. The denudation of the mountains in Salisbury have lessened our streams. In the season of rain there is a more rapid rise and a greater flood than formerly when the forests were standing and the foliage and falling limbs lay quietly covering the earth beneath. Many smaller streams which flowed continuously through the entire season forty or fifty years ago, fail altogether in the summer, and the larger ones are proportionately diminished. Your suggestions in regard to fertilizing our sandy plains are practical, and should be carried out.

Experiments are now in progress to fix the dunes or sand hills which threaten the Suez Canal, by planting the maritime pine and other trees. Last summer I visited the celebrated forest of Fontainbleau, in France, which covers an area of sixty-four square miles. The soil of this wide tract is composed almost entirely of sand, and apparently as dry as the sand plains of Wallingford. Jules Claré, a student of forest science of world-wide fame, says: "The sand here forms ninety-eight per cent. of the earth, and it is almost without water; it would be a drifting desert but for the trees growing and artificially propagated upon it." What has been done with signal success at Fontainbleau shows the practicability of reclaiming the worst deserts that can be found in our State. Many other facts might be cited were it necessary, both from home and foreign fields, to prove the feasibility of this plan of reclaiming sterile lands. If one is to be commended who makes two blades of grass grow where but one grew before, how much more the farmer who makes forests thrive where nothing now grows.

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